HEARING CONSERVATION PROGRAM

OTOSCOPIC EXAMINATION

and

TYPANOMETRY BASICS

28 Jan 2013

Learning Objectives

1. Explain the purpose of otoscopic examination and tympanometry
2. Describe the basic characteristics of a normal and an abnormal tympanogram
3. Describe normal and abnormal physical findings
4. State conditions requiring medical referral
5. Perform otoscopy and tympanometry using proper technique

OTOSCOPIC EXAMINATION

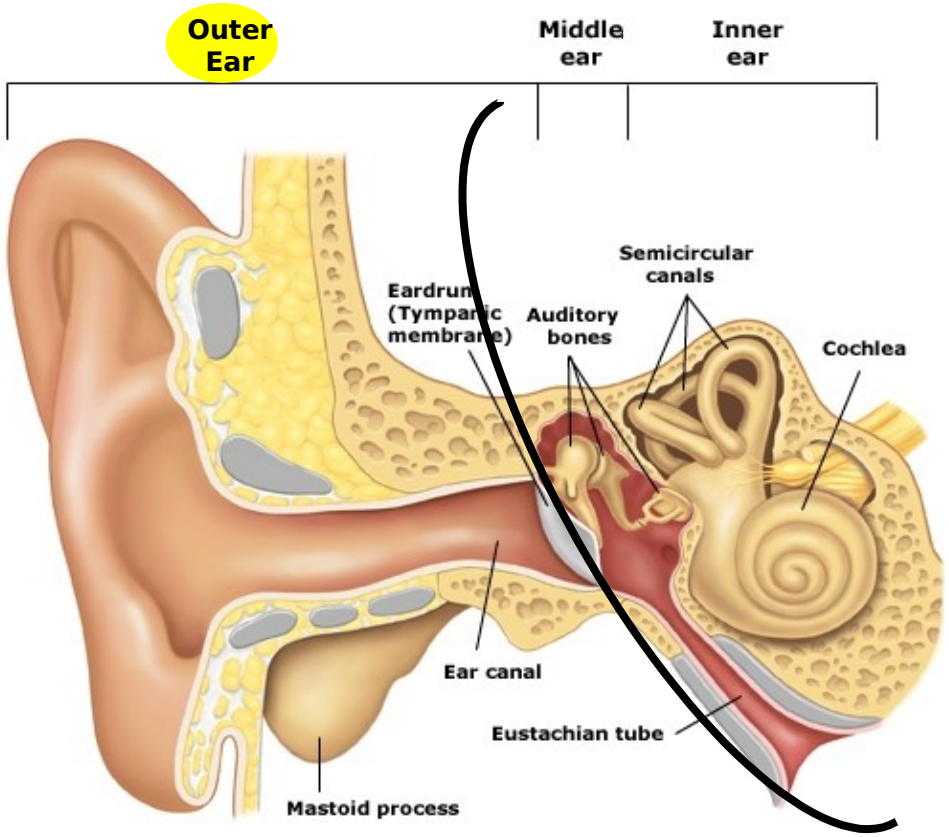
Definition

The examination of the ear canal and tympanic membrane through the use of an otoscope.
An otoscope is a hand-held tool with a speculum and light source to see into the ear canal

Purpose

The otoscopic exam is to ensure that the ear canals are free of any obvious problems prior to fitting hearing protection, performing tympanometry and administering hearing tests

Otoscopy Rules Out Disorders of the Outer Ear



Otoscope Check

- ✓ Check if batteries are fully charged
- ✓ Adjust rheostat to bright white light
- ✓ Fiber-optic better than older bulb-types

Preparation for Otoscopic Exam

1. Observe proper hygiene
   - ➡ wash hands or use gloves
   - ➡ note any bodily fluid or secretion
2. Select a speculum of proper size
   - ➡ larger size ensures a good view
3. Lock speculum into place
4. Change/discard the speculum
   - ➡ after each patient
   - ➡ after each ear of any patient with draining ear(s)

Examination Method

KEY: #1 Otoscope placement
#2 Eye placement

1. **Grip otoscope firmly and comfortably**
2. **Grasp upper edge of the ear (helix) with the opposite hand**
3. **Pull pinna gently upward & back to straighten the ear canal**
4. **Insert lighted otoscope past the first canal bend**
5. **Rest your fingers against the patient's head to avoid injury if patient moves suddenly**
6. **<u>NOW</u> put your eye up to the otoscope eyepiece**

Examination Method cont…

7. Examine the ENTIRE canal and tympanic membrane
8. Dispose speculum, turn off otoscope light

- Don't be satisfied with a partial viewing
- NO
prop

YOUR GOAL

"Within Normal Limits"
or
"Abnormal"

Do not diagnose or label pathology

When to Do an Otoscopic Examination

Before…

- Testing, IF there is an ENT complaint
- Tympanometry
- HPD Fitting

When…

- A positive STS is discovered
- A low frequency or flat hearing loss is detected

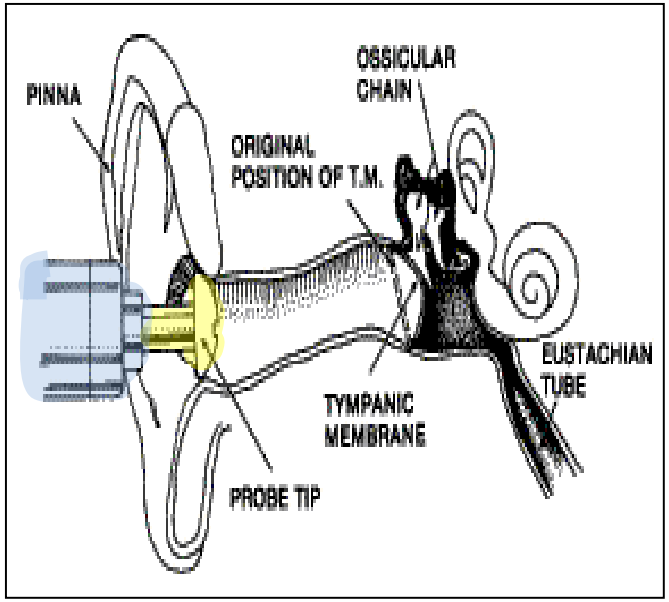
DEFINITION

What is Tympanometry?

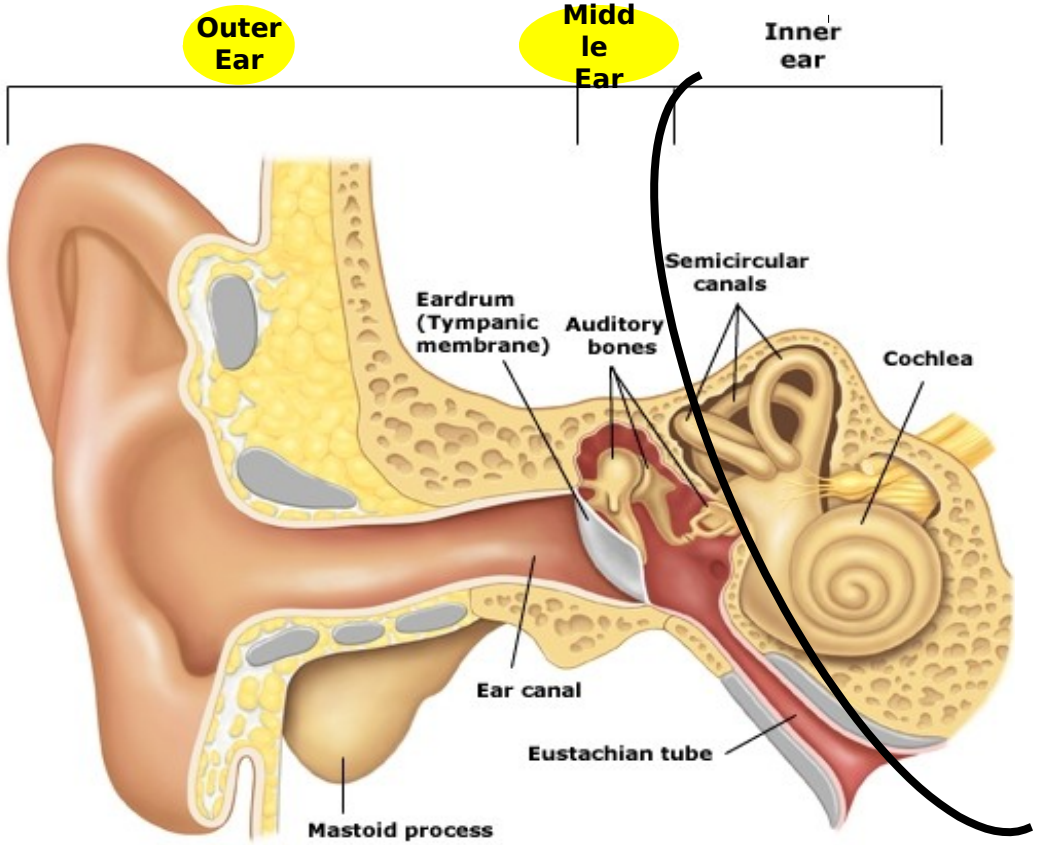
A measurement technique that assesses function of the middle ear

The technique uses

- **a) an acoustic input signal**
- **b) air pressure**
- **c) electronic measurement**



Tympanometry Rules Out Disorders of the Middle Ear



PURPOSE

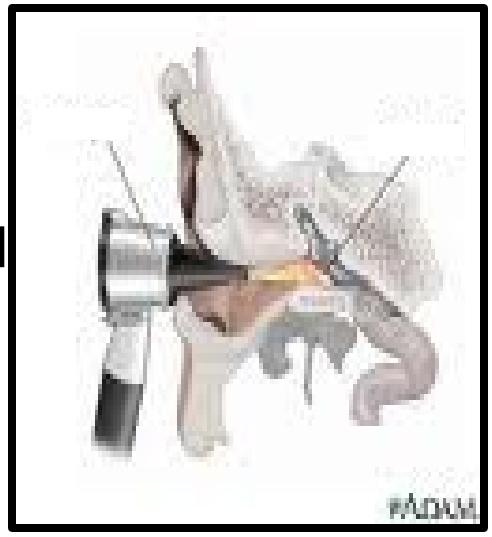
Why use Tympanometry?

- ✓ **To identify patients who require medical referral for middle ear pathology**
- ✓ **To differentiate conductive from sensorineural hearing disorders**
- ✓ **To track the progress of middle ear pathologies unde medical treatment**
- ✓ **Fast, objective, highly accura**

PROTOCOL

When will you use Tympanometry?

1. After otoscopy
2. Part of the referral procedu
3. If positive STS is present
4. If patient complains of ear fullness or pressure

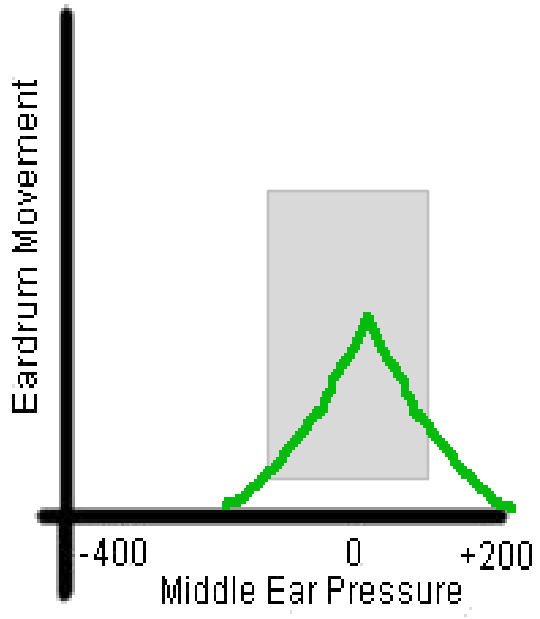


NEVER USE TYMPANOMETRY WHEN THERE HAS BEEN MIDDLE EAR (BONE) SURGERY

How Does Tympanometry Work?

- Probe inserted and seals ear canal
- Pump varies pressure against eardrum
- Pure tone is sent into ear
- Tympanometer measures how much sound gets through the eardrum
- Results indicate the flexibility of the eardrum and middle ear

Normal Tympanogram
"Type A"



Inverted "V" or Mountain

Peak placement

Horizontal	Vertical
-150 to +50	0.2 to 1.8

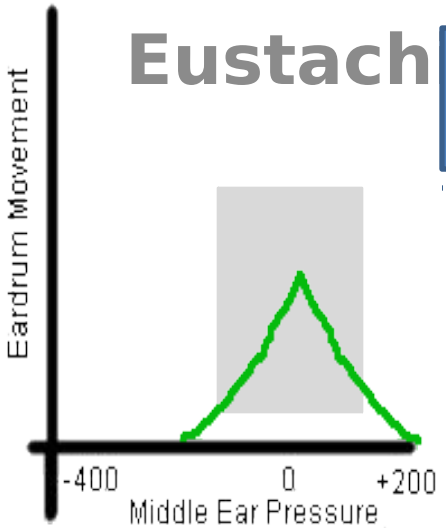
Display uses "box" or shaded area to show normal range

Interpretation – Type A

Normal eardrum movement

Normal middle ear pressure

Eustachian Tube is functioning normally



Normal Outer/Middle Ear

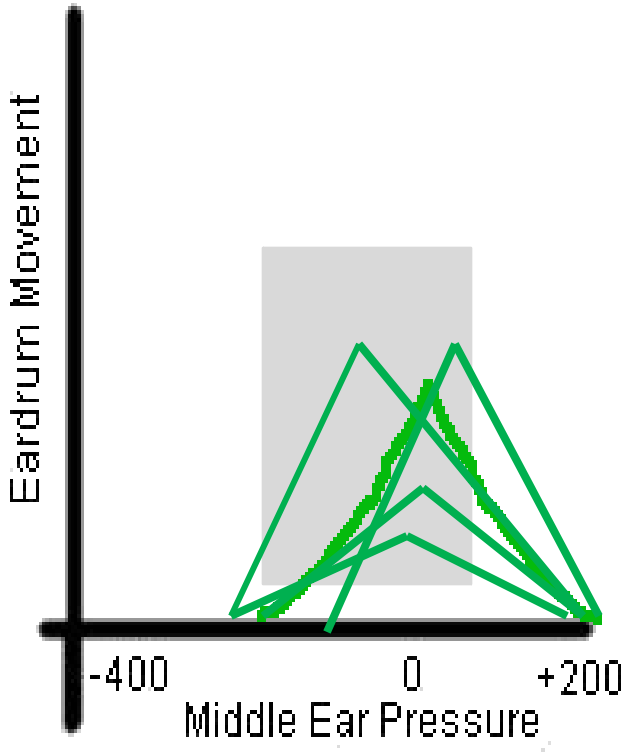
No conductive HL

STS is inner ear related

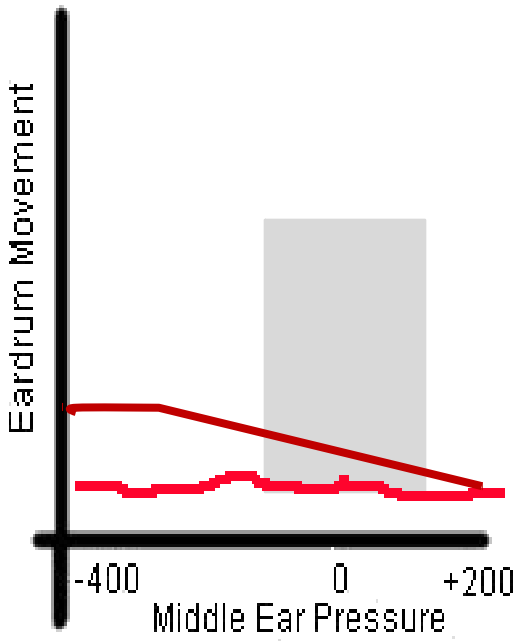
Variations of Normal Type A

Peak
Horizontal
-150 to +50

Vertical
0.2 to 1.8



Abnormal Tympanogram "Type B"



Flat or poorly defined peak

Peak Placement

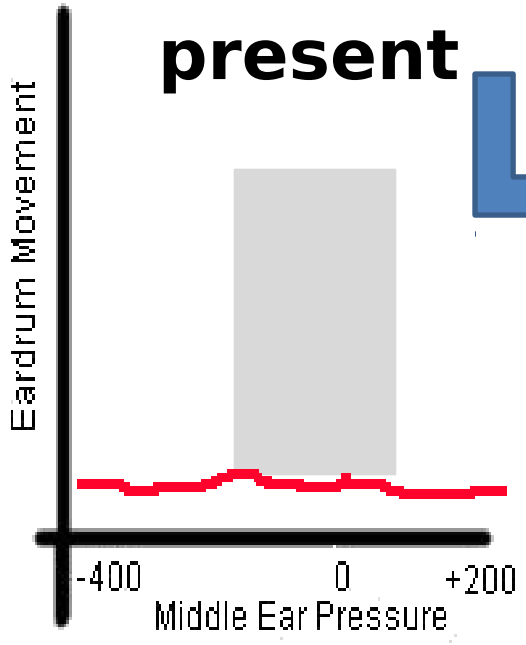
Absent or poorly defined

Horizontal	Vertical
> -150	< 0.2

Interpretation - Type B

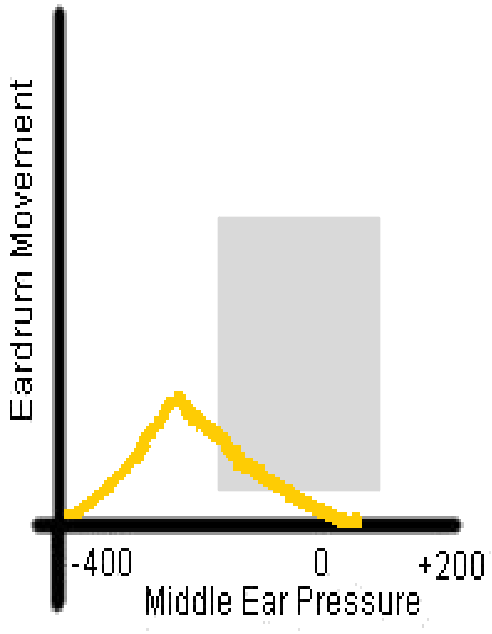
Eardrum movement minimal or absent

Outer and/or middle ear disorder present



- **Ear canal may be occluded**
- **Eustachian Tube not functioning normally**
- **Otitis Media or ME Effusion**
- **Eardrum has perforation**
- **Mild hearing loss in low Hz**

Abnormal Tympanogram "Type C"



Inverted "V" off center to left

Clearly defined peak

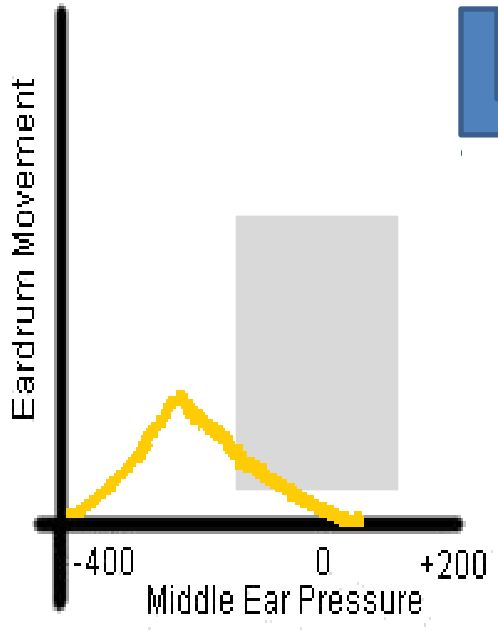
Peak placement

Horizontal	Vertical
> -150	0.2 to 1.8

Interpretation - Type C

Negative middle ear pressure

Eustachian Tube function abnormal



Recent air flight or diving

Symptoms of congestion

Hearing normal or slight loss

@ 500-1000Hz

Disposition of Patients with Abnormal Tympanograms

General Rule ⇨ ***Medical referral***

Final Decision ⇨ ***Local resources and SOP***

To Determine Referral

Request return for follow-up tympanogram

Otitis Media or Middle Ear Effusion

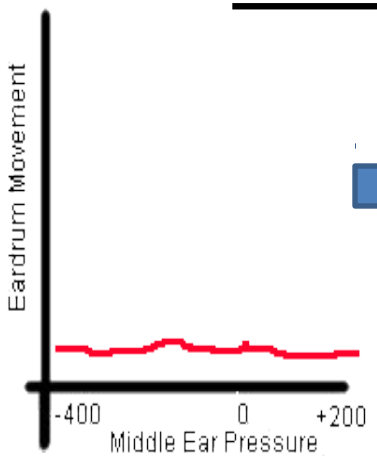
onset to resolution

Tympanograms can progress

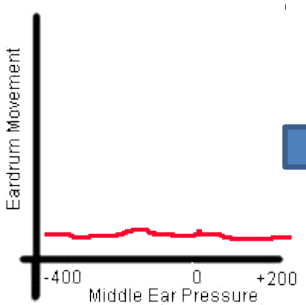
Type C >> Type B >> Type C >> Type A

over 10-14 day period

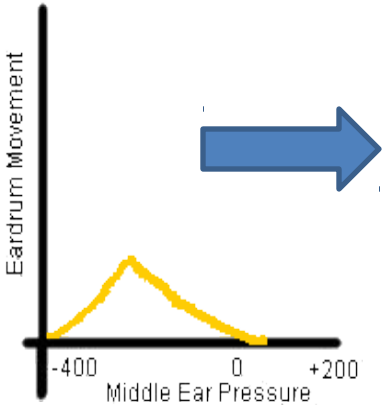
Referral Protocol



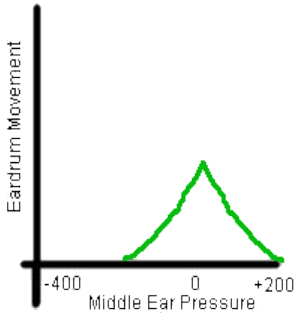
Refer to MO or Audiology



Abnormal Action required



Test again 10-14 days

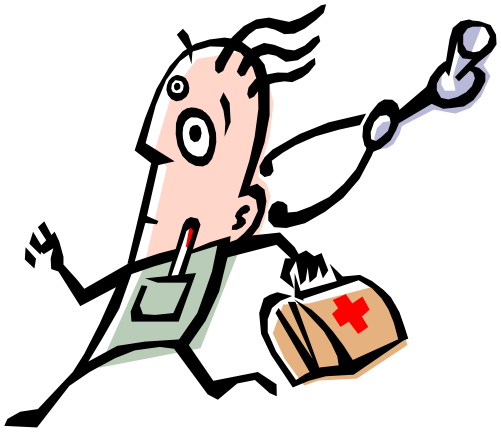


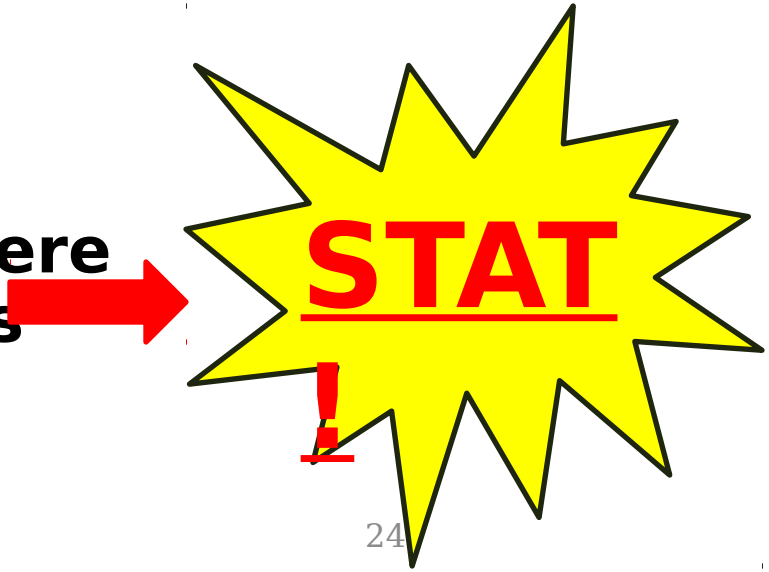
Normal No action required

SUMMARY

Referral to Medical Officer when…

- Pain or discomfort is reported
- Drainage is visible
- Perforation is visible
- Tympanic membrane is bulging
- Ear canal is blocked by cerumen or foreign body
- Complaint of sudden severe hearing loss with tinnitus and/or dizziness
- When in doubt





SUMMARY

OHC Technician Responsibilities

1. **Always perform otoscopy first**
2. **Interpret tympanograms as "Normal" or "Abnormal" only**
3. **Consider all information before referral**
   - ✓ **Patient history**
   - ✓ **Otoscopy**
   - ✓ **Tympanogram**
   - ✓ **Audiograms**

PUTTING OTOSCOPY AND TYPANOMETRY TOGETHER

“Within Normal Limits”

Ear Canals clear and free of obvious problems

- **discharge, masses, impacted cerumen, foreign bodies, inflammation**

Tympanic membrane appearance

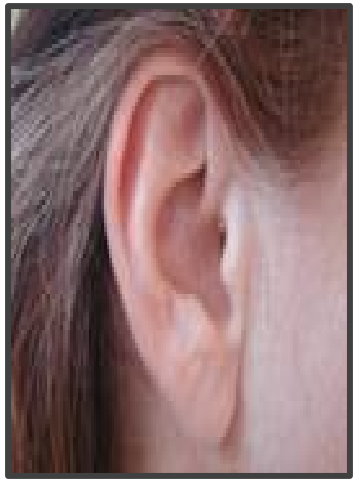
- **translucent, pearly gray**
- **healthy color**

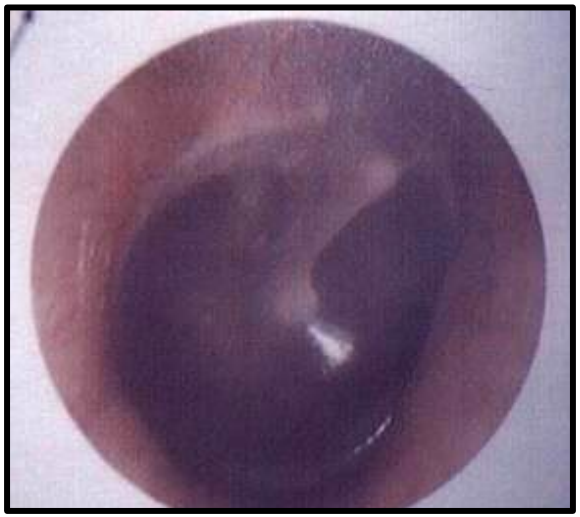
Eardrum landmarks

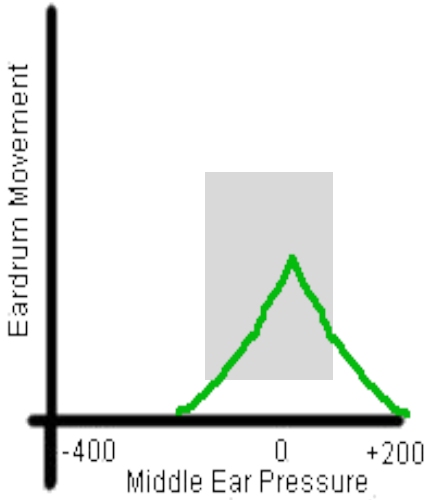
- **Cone of light from center to membrane edge**

Cerumen is normal unless occludes view of TM > 50%

“Within Normal Limits”







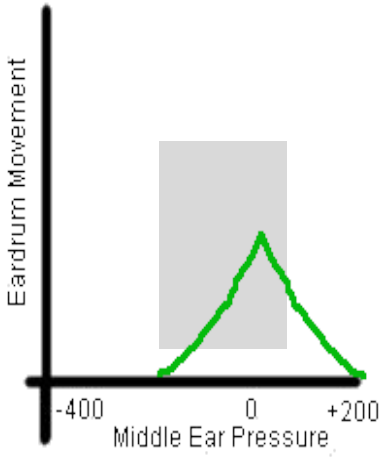
Type A
Normal Peak
Normal Pressure

Excessive Cerumen

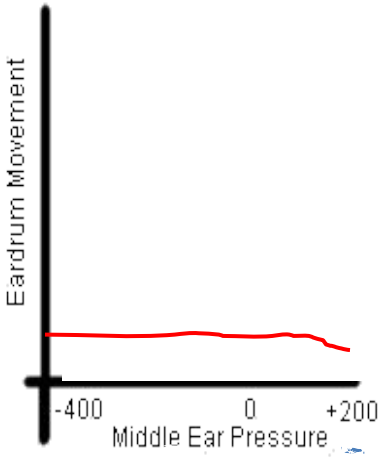
If you can't see at least half the TM, then cleaning is recommended

If the TM is normal, proceed with hearing test and refer for removal

Type A
If not fully occluded



Type B
If fully occluded

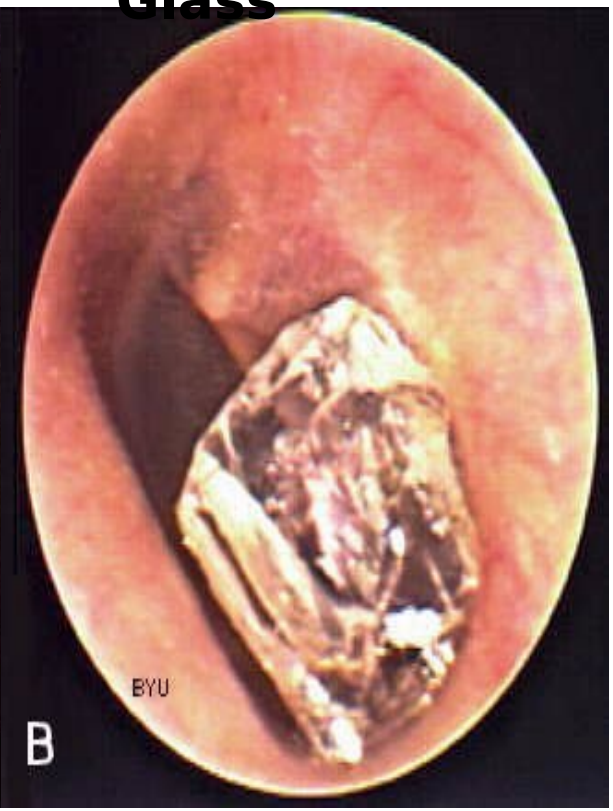


Photo's courtesy of Dr. Roy F. Sullivan, Ph.D.

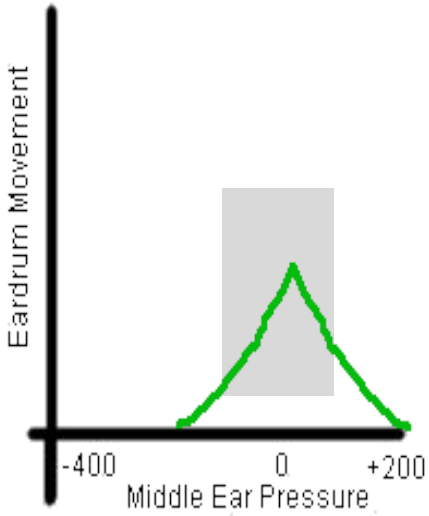
Foreign Bodies

Insect on Canal Wall

Shattered Glass



Photo's courtesy of Dr. Roy F. Sullivan, Ph.D.

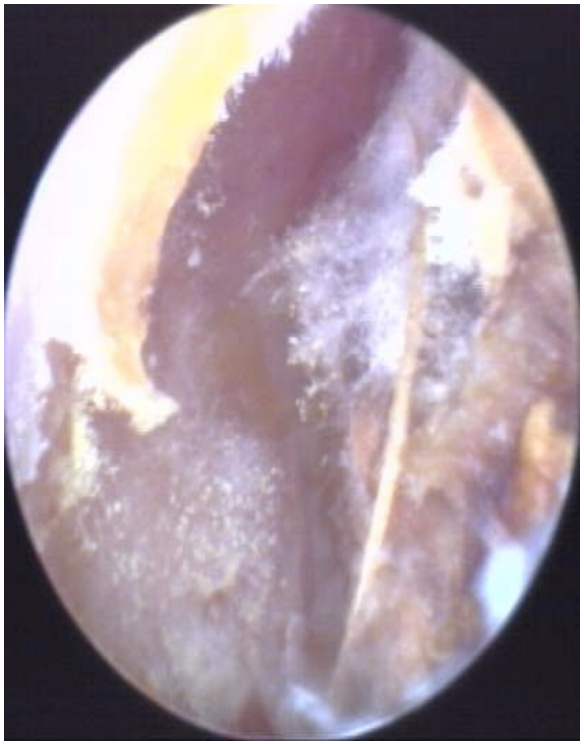


Type A

Normal Peak Normal Pressure unless foreign body fully occludes canal

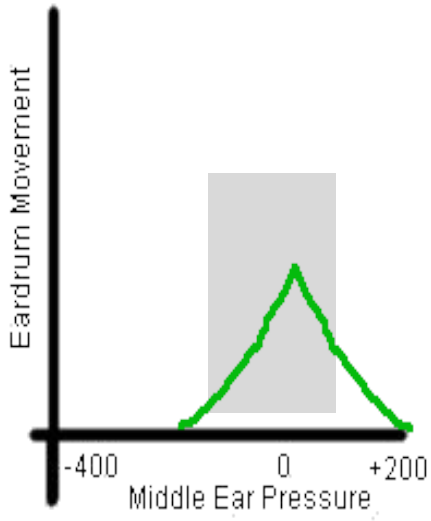
Cotton Swab/Earplug Residue

Cotton Swab Residue



Earplug One Year After Rock Concert

Photo's courtesy of Dr. Roy F. Sullivan, Ph.D.

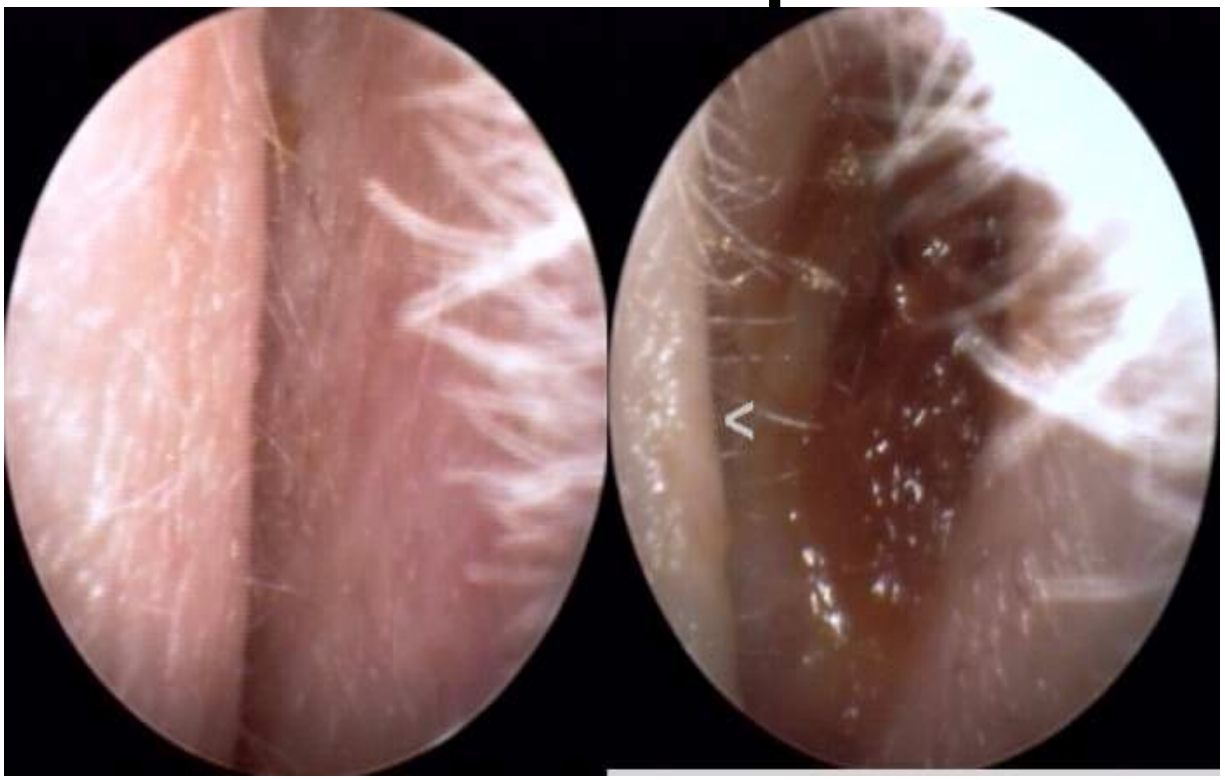


Type A

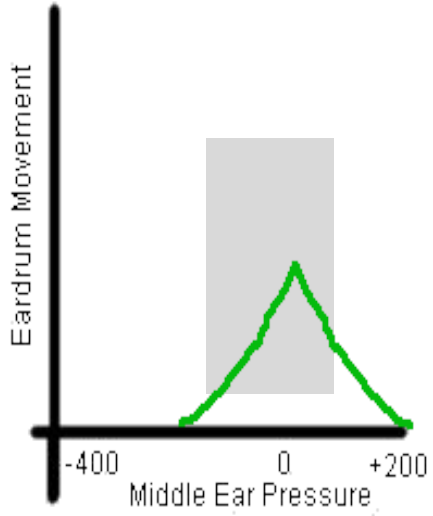
Normal Peak Normal Pressure unless foreign body fully occludes canal

Collapsing Canals

When patients display a “flat” hearing loss, rule out by observing ear canal as you press pinna

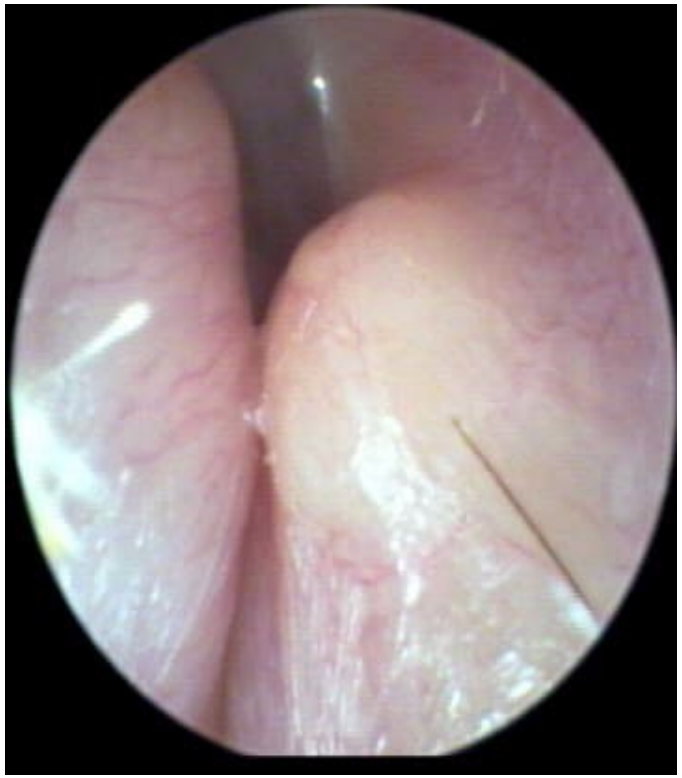


Photo’s courtesy of Dr. Roy F. Sullivan, Ph.D.



Type A
Normal Peak Normal Pressure
tension of headphone collapses canal

Exostoses

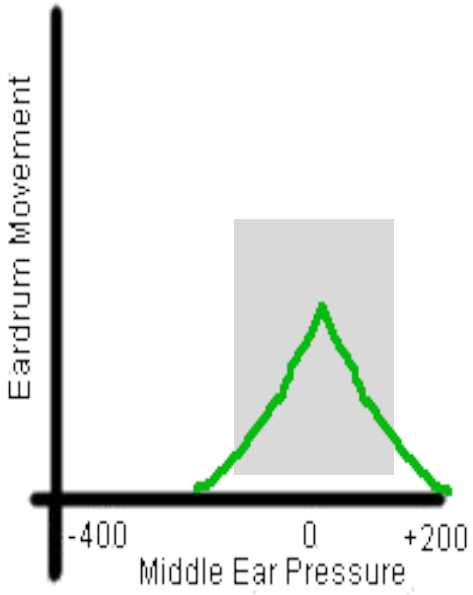


Photo's courtesy of Dr. Roy F. Sullivan, Ph.D.

Will not affect the hearing test unless ear canal fully occluded

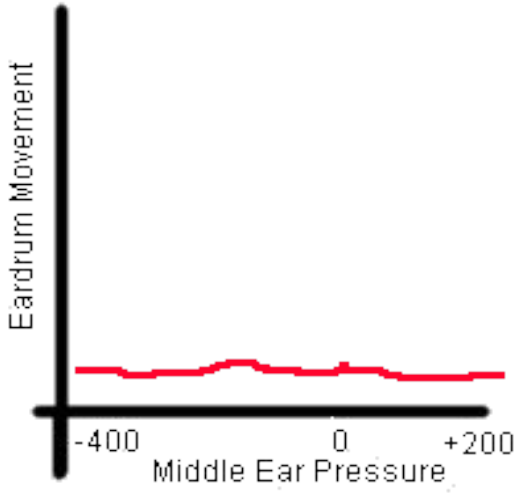
Interferes with earplug insertion

Interferes with otoscopy



Type A
Normal Peak Normal Pressure unless fully occludes canal

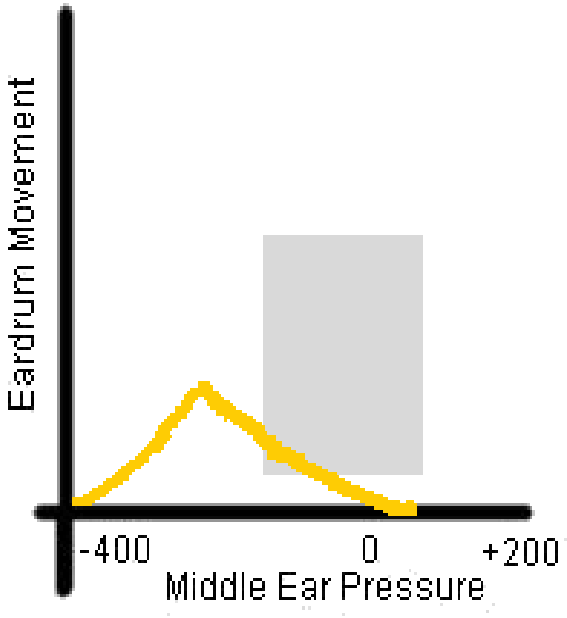
Eardrum Perforations



Size of hole will affect hearing test

Type B
Flat
Large Ear Canal Volume

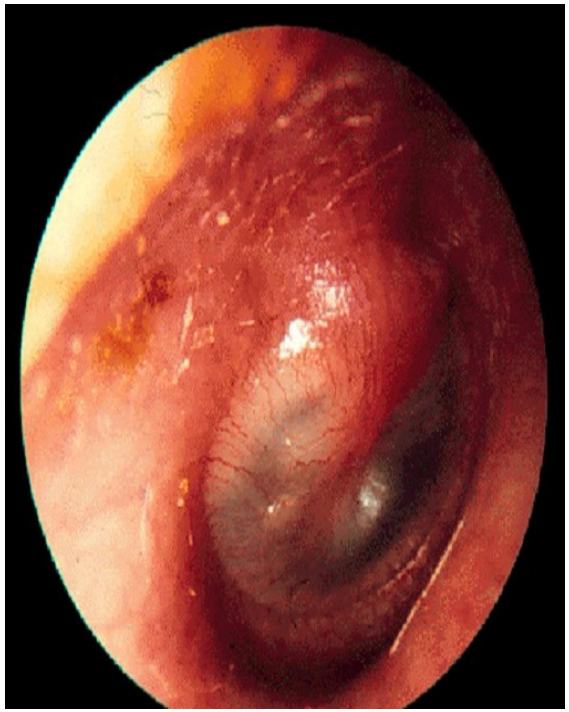
Retracted Eardrum

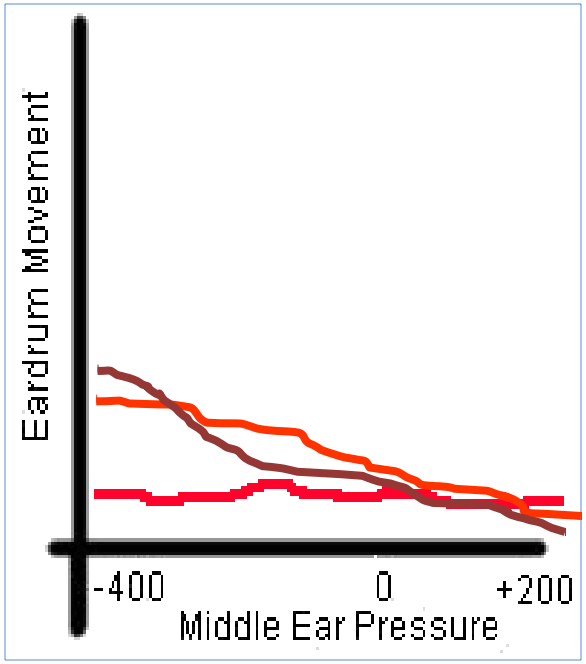


Type C
Abnormal Negative Pressure

Photo's courtesy of Dr. Roy F. Sullivan, Ph.D.

Otitis Media / Middle Ear Effusion

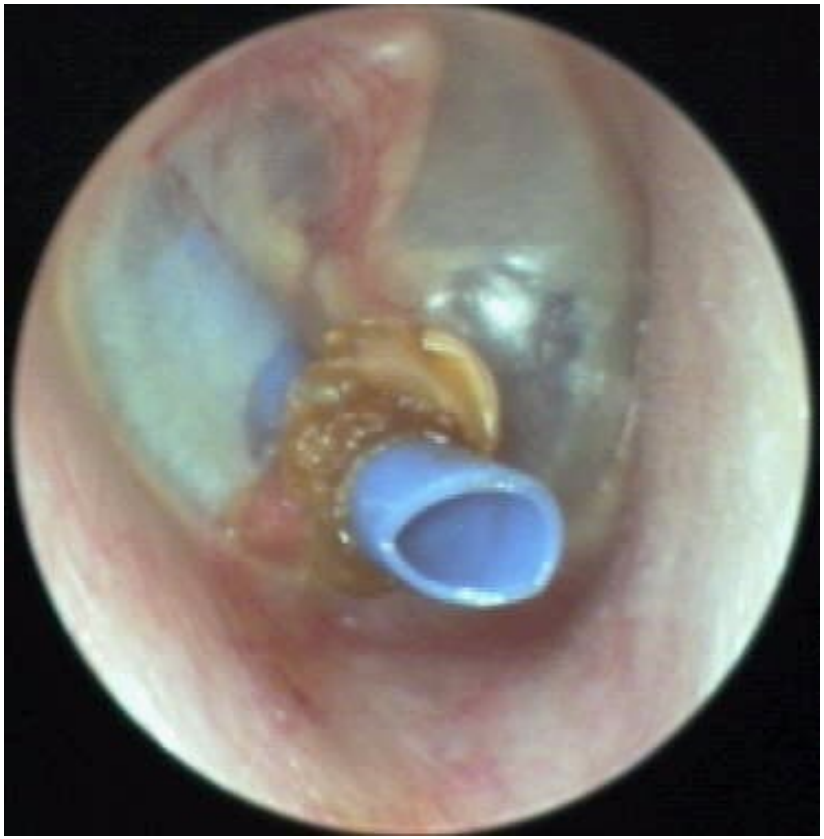


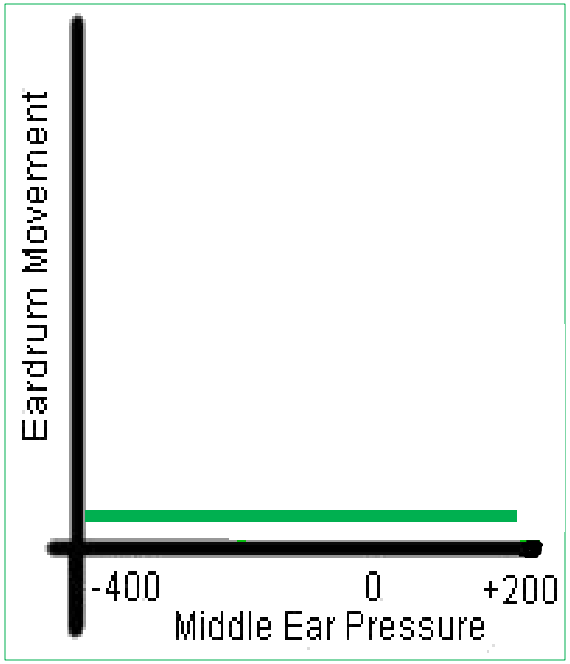


Type B
Flat - no peak
Normal ear canal volume

Photo's courtesy of Dr. Roy F. Sullivan, Ph.D.

Pressure Equalization (PE) Tubes or Ventilation Tubes





Type C
Flat straight line
Huge ear canal volume

Photo's courtesy of Dr. Roy F. Sullivan, Ph.D.

Other Middle Ear Diseases

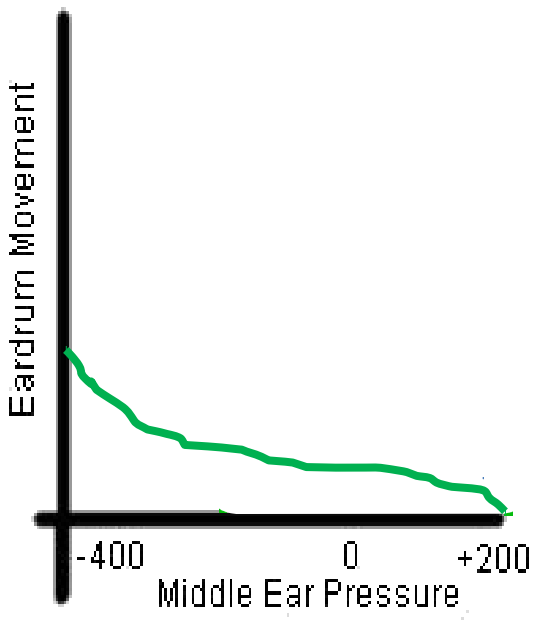
Cholesteatoma Tympanosclerosis

Tymp Types Vary

depends on
- **stiffness of TM**

&
- **size of mass in middle ear**

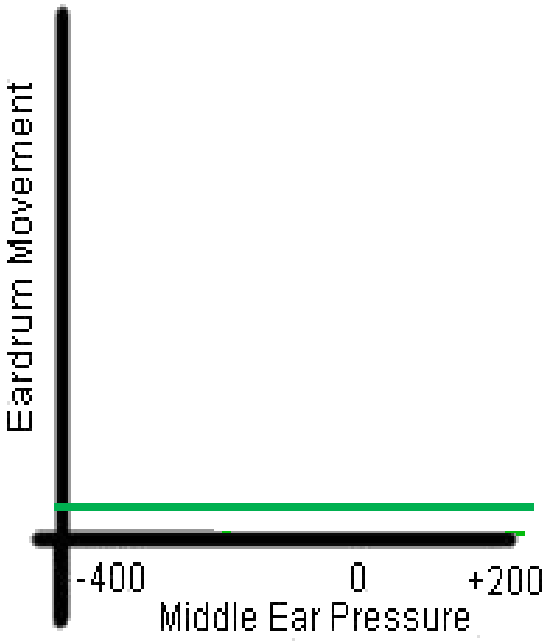
Patient Scenario #1



- Patient Complaints : congestion
  recent head cold
- Postive STS
- Large threshold shifts at 500Hz & 1000Hz
- Otoscopy – slightly red TM

Do you refer?

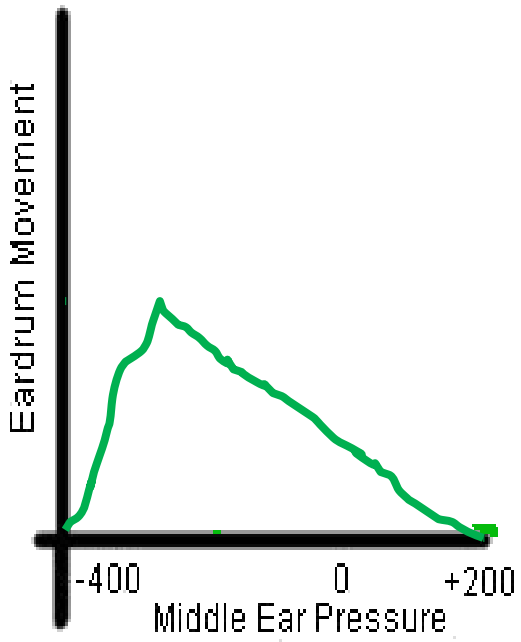
Patient Scenario #2



- **Patient Complaints: sounds are muffled gradually noticed it**
- **Postive STS for most frequencies**
- **Otoscopy - cerumen in canal**
  --unsure if fully occluded

Do you refer?

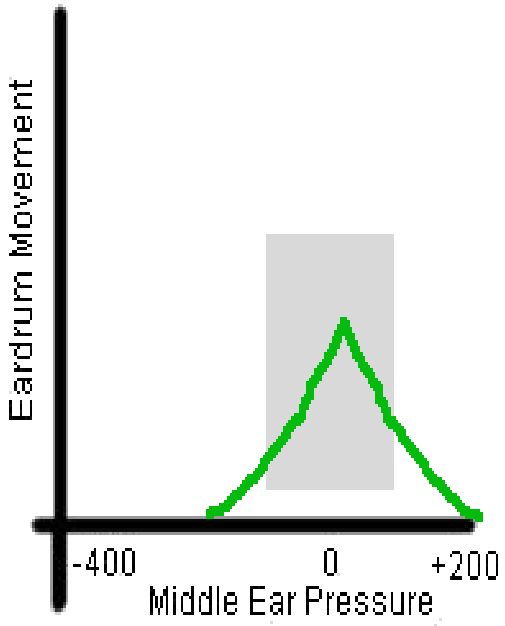
Patient Scenario #3



- **Patient Complaints:**
  feels plugged up
  recent airplane flight
- **Positive STS,**
  decreased hearing
  in lower frequencies.
- **Otoscopy**
  eardrum good color
  ossicles very visible

Do you refer?

Patient Scenario #4



- **Patient Complaints:**
  - **trouble hearing in noise**
  - **ringing in both ears**
- **Positive STS**
  - **in high frequencies**
- **Otoscopy**
  - **clear canal**
  - **TM normal color**

Do you refer?

Otoscopy and Tympanometry

- Otoscopic examination reveals condition ear canal and eardrum
- Tympanometry is a fast, objective, accurate assessment of middle ear status and function
- A Tympanometer measures eardrum movement during controlled pressure changes
- A Tympanogram shows results in graphic form
- Refer to medical officer or audiologist for possible conductive disorders

QUESTIONS ?